

**SMALL ON-BOARD ENVIRONMENTAL DIAGNOSTIC SENSORS
PACKAGE (SOBEDS)**

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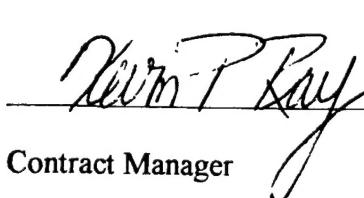
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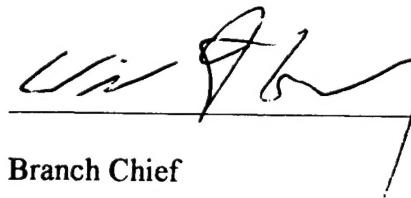
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This technical report has been reviewed and is approved for publication.



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* (This report has been reviewed by the ESC Public Affairs Office (ESC/PAM) and is releasable to the National Technical Information Service (NTIS).)

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13. ABSTRACT (Maximum 200 words) This report contains the summary of the scientific and engineering work performed during the most recent year as part of the development of the High Energy Proton instrument (HEP) and of the Low Energy Particle and Dosimetry instrument (LEPDOS). These instruments are part of the SOBEDS suite of instruments being developed by Amptek, Inc. The purpose of the HEP instrument is to measure the energy spectrum of energetic protons, specifically to obtain a differential spectrum for $25 < E < 440$ MeV and integral counts for $E > 440$ MeV. The purpose of the LEPDOS instrument is to measure: 1) the lower energy protons and electrons that may cause spacecraft anomalies, specifically protons from 0.7 to 80 MeV and electrons from 5 to > 250 keV, 2) the dose and dose rate experienced by spacecraft electronics, 3) particles causing single event effects, and 4) to provide real-time warnings to spacecraft and operators of environmental conditions likely to cause anomalies, such as surface charging and deep dielectric charging.			
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1. Introduction

This report contains the summary of the scientific and engineering work performed during the most recent year as part of the development of the High Energy Proton instrument (HEP) and of the Low Energy Particle and Dosimetry instrument (LEPDOS). These instruments are part of the SOBEDS suite of instruments being developed by Amptek, Inc. The purpose of the HEP instrument is to measure the energy spectrum of energetic protons, specifically to obtain a differential spectrum for $25 \leq E \leq 440$ MeV and integral counts for $E > 440$ MeV. The purpose of the LEPDOS instrument is to measure: 1) the lower energy protons and electrons that may cause spacecraft anomalies, specifically protons from 0.7 to 80 MeV and electrons from 5 to > 250 keV, 2) the dose and dose rate experienced by spacecraft electronics, 3) particles causing single event effects, and 4) to provide real-time warnings to spacecraft and operators of environmental conditions likely to cause anomalies, such as surface charging and deep dielectric charging.

The first five years of this contract effort included the research, development, and fabrication of three flight LEPDOS units, including one with an ESA (electrostatic analyzer), and a flight HEP unit. At the conclusion of this five year effort, the instruments were as complete as possible, without specifying a spacecraft interface¹. The second five year portion of the contract is to cover spacecraft specific engineering efforts, spacecraft integration, and initial flight support. This effort cannot proceed until specific spacecraft are chosen by the AFRL/VSSB contract monitor and the contract monitor tasks Amptek to carry out the spacecraft specific work.

2. High Energy Proton Telescope (HEP)

The HEP instrument consists of two separate packages, a sensor head and an electronics box. Both the flight sensor head and an engineering model sensor head were completed during the initial effort. They are fully completed, including the sensors themselves, the electronics, and the package. The electronics box consists of five major electronic sub-assemblies: an analog board, a DSP board, a CPU board, an I/O board, and a power supply board. Flight analog, DSP, and CPU boards have been completed. The onboard software, I/O board, and Power board are all spacecraft specific. Therefore, they are in protoflight configuration, pending specification of the spacecraft interface. HEP is in storage in Amptek's vault, pending assignment of a spacecraft.

During the most recent year, we received the flight D4 detector for HEP. The previously ordered detector did not meet the manufacturer's specifications, so a replacement detector had been ordered. It was received, underwent bench testing to verify compliance with the manufacturer's specifications, and installed into the HEP flight sensor head. A preliminary test of the reassembled sensor head was completed. In addition, we received comments from the referees regarding a research paper which was submitted to the journal "Nuclear Instruments and Methods in Scientific Research" and the paper was revised accordingly.

3. Low Energy Particle and Dosimetry Instrument (LEPDOS)

Three flight LEPDOS instruments were developed during the initial phase of this contract. They included two "standard" instruments, designated S/N 004 and 005, and one with an ESA, designated S/N 007. The unit with the ESA, S/N 007, was launched on 6 Aug 2001 into geosynchronous orbit aboard a DSP spacecraft. We provided support for on-orbit checkout, verifying the initial flight data which was provided to us. The overall instrument operation appears good, and in particular the ESA which is new for this unit is working extremely well.

The other two units, S/N 004 and 005, have been completed and are now in storage at Amptek. Both units contain power supply boards suitable for a standard 28V power bus. S/N 004 contains hardware and software for a MILSTD-1553B serial telemetry interface, while S/N 005 contains hardware and software for an RS422 serial telemetry interface. In the past year we have provided some support to AFRL/VSSB as they examine possible spacecraft opportunities. We are also in the process of writing a calibration report, an archival report to describe the calibration procedures and results. We will support spacecraft interfacing efforts when directed by the technical monitor.

¹ A summary of the first five years is found in AFRL-VS-TR-2001-1620, *Small On-Board Environmental Diagnostic Sensors Package (SOBEDS)*.